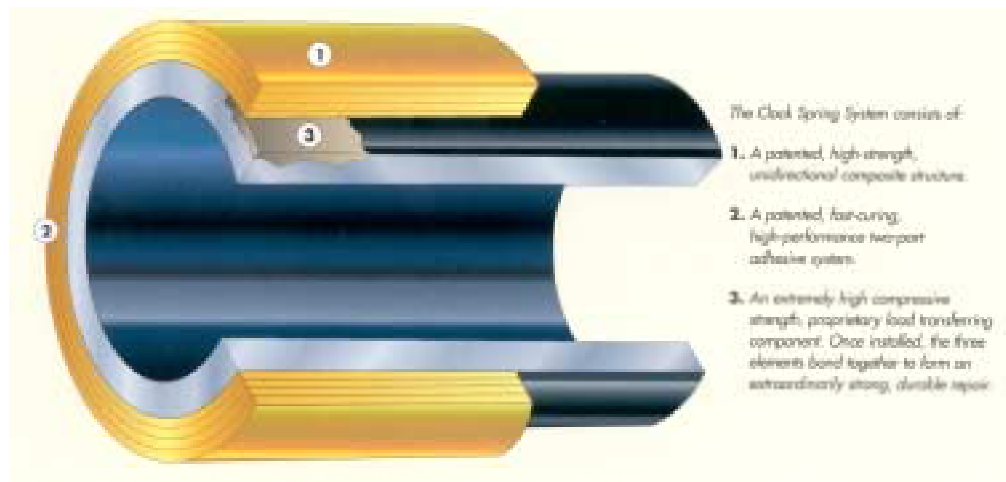


# **Pipeline Repair Using Clock Spring Composite Sleeve Reinforcement**

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Pipeline companies may periodically find defects in their pipelines during inspections and normal operation and maintenance. The defect may have been caused by excavation damage, corrosion, construction errors, or the manufacturing process. Steel sleeves or repair clamps were typically used to repair pipeline damage or defects or the damaged section was shut down and replaced. When properly applied the Clock Spring composite sleeve restores the pipeline to safe operating condition without having to shut down and replace the pipeline. Clock Spring composite sleeves are used to make temporary and permanent repairs on natural gas and liquid pipelines. W.U.T.C. pipeline safety staff inspected and documented the following example of Clock Spring installation on a damaged section of pipeline.





### Locating Anomaly

The general area of the anomaly (damage) is excavated based on distance from a reference point such as a valve or number of girth welds from the inspection tool launch point.



### Excavation

The pipeline is exposed, the anomaly located and a preliminary evaluation conducted.



### Pinpointing Anomaly

Exact measurements are taken from a point of reference such as a girth weld. The preliminary size and orientation of the anomaly is documented.



### Documenting Pipeline Condition

All information is documented prior to removal of the wrap or coating.



### Coating Removal

The pipeline's protective wrap or coating is removed in preparation for sand blasting.



### Sandblasting

The pipeline is sandblasted to a clean bare metal condition.



### Preparation of Pipeline For Evaluation

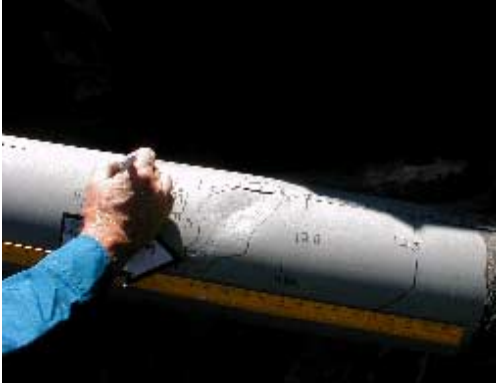
The sandblasted pipeline is prepared for an in depth evaluation of the anomaly.



### Defect Measurement

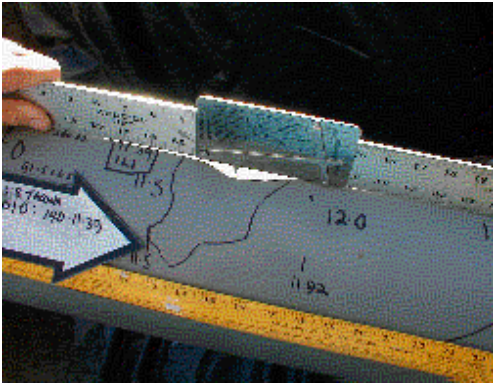
The anomaly is measured, documented and examined for any cracks, grooves or other imperfections which could affect the strength of the pipeline.





### Defect Evaluation

Precise measurements are taken of the size of the anomaly. The damaged area is also examined for any surface cracks or other strength reducing damage. The area is photographed.



### Depth Measurement

The depth of the damage is measured and recorded. The damaged area is also photographed throughout the evaluation. The damage is evaluated using an industry recognized criteria to determine whether the damage can be repaired or must be cut out.



### Ultrasonic Thickness Test

Ultrasonic wall thickness measurements are taken to evaluate any apparent wall loss. The damage is evaluated using an industry recognized criteria to determine whether the damage can be repaired or must be cut out.



### Magnetic Flux Crack Detection

Since many surface cracks are not visible to the naked eye a magnetic flux evaluation is conducted to determine the extent of any cracks or other strength reducing imperfections in the pipeline.



### Surface Grinding

The damaged area is ground smooth to remove any gouges or strength reducing surface cracks.



### Final Documentation and Evaluation

The anomaly is further evaluated prior to the installation of the Clock Spring repair sleeve.



### Ultrasonic Wall Thickness Tests

Ultrasonic wall thickness measurements are again taken after grinding to measure actual remaining wall thickness prior to the installation of the Clock Spring.



### Test Fit and Location Marking

The ClockSpring is test fitted and the location is marked on the pipeline to ensure that the repair sleeve is centered around the actual damage on the pipeline.

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### Preparing for Clock Spring Installation

A two way tape strip is placed on the pipeline to hold the Clock Spring in place while it is wound around the pipeline.



### Filler Material

A filler material is mixed in preparation to fill in the anomaly on the pipeline.



### Filling the Anomaly

The filler material is spread over the damaged area of the pipeline and around the two way tape. The tape has a protective outer layer that keeps the filler from adhering and will be removed prior to the start of the Clock Spring installation.



### Preparing Resin

A mixture of epoxy resin is prepared. The resin is used to adhere the Clock Spring to the pipeline and to adhere between the individual layers of the Clock Spring.





### Resin Installation

The resin is spread around the entire circumference of the pipeline.



### Clock Spring Installation

The Clock Spring is adhered to the two way tape and is wrapped circumferentially around the pipeline.



### Clock Spring Installation

Resin is spread in between each layer as the Clock Spring is wrapped around the pipeline.



### Clock Spring Tightening

A strap tightener is placed around the circumference of the Clock Spring and tightened until all excess resin and filler is squeezed out of the sleeve.



### Final Installation

Strapping tape is placed around the Clock Spring to hold it while it cures and hardens. This takes approximately 2 hours.



### Primer and Re-Wrap

The pipeline is primed and a protective wrap or coating will then be re-applied. Steel straps will be wrapped around the Clock Spring prior to the final protective coating being applied.